

WHAT IS CLAIMED IS:

1. An ink jet printing apparatus based on a serial scan method which prints a printing medium by using a print  
5 head formed with a plurality of nozzles through which ink can be ejected and selectively ejecting ink through the plurality of nozzles in said print head in accordance with dot patterns of dot matrices corresponding to respective gradation values, on the basis of image data converted into  
10 n values ( $n \geq 3$ ) using gradation patterns for a systematic dither method, the apparatus comprising:

main scanning means for scanning said print head over said printed medium in a sub-scanning direction different from a direction in which said nozzles are arranged;

15 conveying means for conveying said printing medium by a predetermined amount K (where  $K = a \times L$  (a is a natural number and L is the size of said gradation patterns in the direction in which said nozzles are arranged) or  $K = L/b$  (b is a natural number)) in the direction in which said  
20 nozzles are arranged, between a preceding scan and a next scan of the print head executed by said main scanning means;

first changing means for shifting correspondences between the image data and said plurality of nozzles in the direction in which said nozzles are arranged; and

25 second changing means for changing operated dot patterns so as to allow the selective use of a plurality of different dot patterns indicating the same gradation

value.

2. An ink jet printing apparatus as claimed in claim 1, wherein said first changing means shifts the  
5 correspondences between said image data and said plurality of nozzles so as to reduce the number of nozzles through which ink is ejected during a first main scan of said print head.

10 3. An ink jet printing apparatus as claimed in claim 1, wherein said first changing means adds data that does not cause any ink to be ejected, as image data corresponding to the first main scan of said print head, to shift the correspondences between said image data and said plurality  
15 of nozzles by an amount corresponding to the added data.

4. An ink jet printing apparatus as claimed in claim 3, wherein nozzles corresponding to the data added by said first changing means pass through a blank area at a leading  
20 end of said printing medium during the first main scan of said print head.

5. An ink jet printing apparatus as claimed in claim 1, wherein said first changing means shifts the  
25 correspondences between said image data and said plurality of nozzles and said second changing means changes said dot patterns, for each page or each print job or every time a

certain number of print sheets are printed.

6. An ink jet printing apparatus based on a serial scan method which prints a printing medium by using a print  
5 head formed with a plurality of nozzles through which ink can be ejected and selectively ejecting ink through the plurality of nozzles in said print head in accordance with dot patterns of dot matrices corresponding to respective gradation values, on the basis of image data converted into  
10  $n$  values ( $n \geq 3$ ) using gradation patterns for a systematic dither method, the apparatus comprising:

main scanning means for scanning said print head over said printing medium in a sub-scanning direction different from a direction in which said nozzles are arranged;

15 conveying means for conveying said printing medium by a predetermined amount  $K$  (where  $K = a \times L$  ( $a$  is a natural number and  $L$  is the size of said gradation patterns in the direction in which said nozzles are arranged) or  $K = L/b$  ( $b$  is a natural number)) in the direction in which said  
20 nozzles are arranged, between a preceding scan and a next scan of the print head executed by said main scanning means; and

changing means for changing operated dot patterns so as to allow the selective use of a plurality of different  
25 dot patterns indicating the same gradation value,

wherein said changing means changes said dot patterns for each main scan, each page, or each print job or every

time a certain number of print sheets are printed.

7. An ink jet printing apparatus based on a serial scan method which prints a printing medium by using a print  
5 head formed with a plurality of nozzles through which ink can be ejected and selectively ejecting ink through the plurality of nozzles in said print head in accordance with dot patterns of dot matrices corresponding to respective gradation values, on the basis of image data converted into  
10  $n$  values ( $n \geq 3$ ) using gradation patterns for a systematic dither method, the apparatus comprising:

main scanning means for scanning said print head over said printing medium in a sub-scanning direction different from a direction in which said nozzles are arranged;

15 conveying means for conveying said printing medium by a predetermined amount  $K$  (where  $K = a \times L$  ( $a$  is a natural number and  $L$  is the size of said gradation patterns in the direction in which said nozzles are arranged) or  $K = L/b$  ( $b$  is a natural number)) in the direction in which said  
20 nozzles are arranged, between a preceding scan and a next scan of the print head executed by said main scanning means; and

changing means for shifting correspondences between the image data and said plurality of nozzles in the direction  
25 in which said nozzles are arranged,

wherein the amount by which the correspondences are shifted by said changing means is less than said  $L$ .

8. An ink jet printing apparatus as claimed in claim 7, wherein said changing means shifts the correspondences between said image data and said plurality of nozzles so as to reduce the number of nozzles through which ink is ejected during a first main scan of said print head.

9. An ink jet printing apparatus as claimed in claim 7, wherein said changing means adds data that does not cause any ink to be ejected, as image data corresponding to the first main scan of said print head, to shift the correspondences between said image data and said plurality of nozzles by an amount corresponding to the added data.

10. An ink jet printing apparatus as claimed in claim 7, wherein said changing means shifts the correspondences between said image data and said plurality of nozzles for each page or each print job or every time a certain number of print sheets are printed.

11. An ink jet printing apparatus as claimed in claim 7, further comprising dot pattern changing means for changing operated dot patterns so as to allow the selective use of a plurality of different dot patterns indicating the same gradation value.

12. An ink jet printing apparatus as claimed in claim

11, wherein said dot pattern changing means changes said dot patterns for each main scan, each page, or each print job or every time a certain number of print sheets are printed.

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13. An ink jet printing apparatus based on a serial scan method which prints a printing medium by using a print head formed with a plurality of nozzles through which ink can be ejected and selectively ejecting ink through the plurality of nozzles in said print head in accordance with dot patterns of dot matrices corresponding to respective gradation values, on the basis of image data converted into  $n$  values ( $n \geq 3$ ) using gradation patterns for a systematic dither method, the apparatus comprising:

15        main scanning means for scanning said print head over said printing medium in a sub-scanning direction different from a direction in which said nozzles are arranged;

         conveying means for conveying said printing medium by a predetermined amount  $K$  (where  $K = a \times L$  ( $a$  is a natural number and  $L$  is the size of said gradation patterns in the direction in which said nozzles are arranged) or  $K = L/b$  ( $b$  is a natural number)) in the direction in which said nozzles are arranged, between a preceding scan and a next scan of the print head executed by said main scanning means;

25        first changing means for shifting correspondences between the image data and said plurality of nozzles in the direction in which said nozzles are arranged; and

second changing means for changing operated dot patterns so as to allow the selective use of a plurality of different dot patterns indicating the same gradation value,

5        wherein said first changing means adds data that does not cause any ink to be ejected, as image data corresponding to the first main scan of said print head, to shift the correspondences between said image data and said plurality of nozzles by an amount corresponding to the added data,  
10    and

      wherein said first changing means shifts the correspondences between said image data and said plurality of nozzles and said second changing means changes said dot patters, for each page or each print job or every time a  
15    certain number of print sheets are printed.

14. An ink jet printing method based on a serial scan method which prints a printing medium by using a print head formed with a plurality of nozzles through which ink can  
20    be ejected and selectively ejecting ink through the plurality of nozzles in said print head in accordance with dot patterns of dot matrices corresponding to respective gradation values, on the basis of image data converted into n values ( $n \geq 3$ ) using gradation patterns for a systematic  
25    dither method, the ink jet printing method comprising:

      a main scanning step of scanning said print head over said printing medium in a sub-scanning direction different

from a direction in which said nozzles are arranged;

a conveying step of conveying said printed medium by a predetermined amount  $K$  (where  $K = a \times L$  ( $a$  is a natural number and  $L$  is the size of said gradation patterns in the direction in which said nozzles are arranged) or  $K = L/b$  ( $b$  is a natural number)) in the direction in which said nozzles are arranged, between a preceding scan and a next scan of said print head;

a first changing step of shifting correspondences between the image data and said plurality of nozzles in the direction in which said nozzles are arranged; and

a second changing step of changing operated dot patterns so as to allow the selective use of a plurality of different dot patterns indicating the same gradation value.

15. An ink jet printing method based on a serial scan method which prints a printing medium by using a print head formed with a plurality of nozzles through which ink can be ejected and selectively ejecting ink through the plurality of nozzles in said print head in accordance with dot patterns of dot matrices corresponding to respective gradation values, on the basis of image data converted into  $n$  values ( $n \geq 3$ ) using gradation patterns for a systematic dither method, the ink jet printing method comprising:

a main scanning step of scanning said print head over said printing medium in a sub-scanning direction different

from a direction in which said nozzles are arranged;

a conveying step of conveying said printing medium by a predetermined amount  $K$  (where  $K = a \times L$  ( $a$  is a natural number and  $L$  is the size of said gradation patterns in the direction in which said nozzles are arranged) or  $K = L/b$  ( $b$  is a natural number)) in the direction in which said nozzles are arranged, between a preceding scan and a next scan of said print head; and

a changing step of changing operated dot patterns so as to allow the selective use of a plurality of different dot patterns indicating the same gradation value,

wherein said changing step changes said dot patterns for each main scan, each page, or each print job or every time a certain number of print sheets are printed.

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16. An ink jet printing method based on a serial scan method which prints a printing medium by using a print head formed with a plurality of nozzles through which ink can be ejected and selectively ejecting ink through the plurality of nozzles in said print head in accordance with dot patterns of dot matrices corresponding to respective gradation values, on the basis of image data converted into  $n$  values ( $n \geq 3$ ) using gradation patterns for a systematic dither method, the ink jet printing method comprising:

a main scanning step of scanning said print head over said printing medium in a sub-scanning direction different from a direction in which said nozzles are arranged;

a conveying step of conveying said printing medium by a predetermined amount  $K$  (where  $K = a \times L$  ( $a$  is a natural number and  $L$  is the size of said gradation patterns in the direction in which said nozzles are arranged) or  $K = L/b$  ( $b$  is a natural number)) in the direction in which said nozzles are arranged, between a preceding scan and a next scan of said print head; and

a changing step of shifting correspondences between the image data and said plurality of nozzles in the direction in which said nozzles are arranged,

wherein the amount by which the correspondences are shifted by said changing means is less than said  $L$ .

17. An ink jet printing method based on a serial scan method which prints a printing medium by using a print head formed with a plurality of nozzles through which ink can be ejected and selectively ejecting ink through the plurality of nozzles in said print head in accordance with dot patterns of dot matrices corresponding to respective gradation values, on the basis of image data converted into  $n$  values ( $n \geq 3$ ) using gradation patterns for a systematic dither method, the ink jet printing method comprising:

a main scanning step of scanning said print head over said printing medium in a sub-scanning direction different from a direction in which said nozzles are arranged;

a conveying step of conveying said printing medium by a predetermined amount  $K$  (where  $K = a \times L$  ( $a$  is a natural

number and  $L$  is the size of said gradation patterns in the direction in which said nozzles are arranged) or  $K = L/b$  ( $b$  is a natural number)) in the direction in which said nozzles are arranged, between a preceding scan and a next scan of said print head;

a first changing step of shifting correspondences between the image data and said plurality of nozzles in the direction in which said nozzles are arranged; and

a second changing step of changing operated dot patterns so as to allow the selective use of a plurality of different dot patterns indicating the same gradation value,

wherein said first changing step adds data that does not cause any ink to be ejected, as image data corresponding to the first main scan of said print head, to shift the correspondences between said image data and said plurality of nozzles by an amount corresponding to the added data, and

wherein said first changing step shifts the correspondences between said image data and said plurality of nozzles and said second changing step changes said dot patterns, for each page or each print job or every time a certain number of print sheets are printed.

18. A program for allowing a computer to execute said first changing step and said second changing step of the ink jet printing method as claimed in claim 17.